CLAIMS

1. An *in vitro* method for detecting the presence of demyelinating diseases in an individual, for determining the stage or severity of said diseases in the individual, or for monitoring the effect of the therapy administered to an individual presenting said diseases, comprising:

a) detection and/or quantification of the DUSP6 protein, of the dusp6 gene mRNA, or of the corresponding cDNA in a sample of said individual, and

b) comparison of the DUSP6 protein amount, of the dusp6 gene mRNA amount, or of the corresponding cDNA amount detected in a sample of an individual, with the DUSP6 protein amount, with the dusp6 gene mRNA amount, or with the corresponding cDNA amount detected in samples from control individuals or with normal reference values.

2. A method according to claim 1, wherein demyelinating diseases are, among others, multiple sclerosis, Devic's syndrome, Baló disease, Marchiafava-Bignami disease, central pontine myelinolysis, acute disseminated encephalomyelitis, or acute necrotizing hemorrhagic encephalomyelitis.

3. A method according to the previous claims, wherein said sample is of serum, urine, saliva, feces, or cerebrospinal fluid.

4. A method according to claim 3, wherein said serum, urine, saliva, feces, or cerebrospinal fluid sample to analyze is obtained by any conventional method, preferably surgical resection.

5. A method according to claim 1, wherein said sample to analyze is obtained from an individual who has not previously been diagnosed with a demyelinating disease.

6. A method according to claim 5, wherein said sample to analyze is obtained from an individual who has previously been diagnosed with a demyelinating disease, preferably multiple sclerosis.

7. A method according to claim 1, wherein said sample to analyze is obtained from an individual undergoing treatment, or who has been previously treated against a demyelinating disease, preferably multiple sclerosis.

8. A method according to claim 1, characterized in that it comprises carrying out an extraction of the sample, either for obtaining a protein extract or for obtaining an extract consisting of total RNA.

9. A method according to claim 8, characterized in that detection of the DUSP6 protein comprises a first step of contacting the protein extract of the sample with a composition of one or more specific antibodies against one or more epitopes of the DUSP6 protein, and a second step of quantifying the complexes formed by the antibodies and DUSP6 protein.

10. A method according to claim 9, characterized in that said antibodies comprise monoclonal, polyclonal antibodies, intact or recombinant fragments of them, "combibodies" and Fab or scFv antibody fragments, specific against the DUSP6 protein; these antibodies being human, humanized or of non-human origin.

11. A method according to claims 9 or 10, characterized in that for quantifying the complexes formed by the antibodies and the DUSP6 protein, techniques are used selected from the group formed by Western-blot, ELISA (Enzyme-Linked Immunosorbent Assay), RIA (Radioimmunoassay), Competitive EIA (Competitive Enzyme Immunoassay), DAS-ELISA (Double Antibody Sandwich-ELISA),

immunocytochemical and immunohistochemical techniques, techniques based on the use of protein biochips or microarrays including specific antibodies, assays based on precipitation with colloidal gold in formats such as *dipsticks*; or by means of affinity chromatography techniques, ligand binding assays or lectin binding assays.

12. A method according to claim 8, characterized in that detection of mRNA or corresponding cDNA dusp6 gene comprises a first amplification step of the mRNA included in the total RNA extract, or of the corresponding cDNA synthesized by reverse transcription of the mRNA, and a second quantification step of the amplification product of the mRNA or cDNA of the dusp6 gene.

13. A method according to claim 12, characterized in that amplification is carried out in a qualitative or quantitative manner by means of RT-PCR using oligonucleotide primers, the sequences of the primers used to amplify the dusp6 gene sequence being SEQ ID NO:1 and SEQ ID NO:2, or any other primer pair amplifying dusp6 specifically.

14. A method according to claim 8, characterized in that detection is carried out with mRNA or corresponding cDNA specific probes of the dusp6 gene by means of techniques such as, for example, Northern-blot or Northern transfer.

15. A method according to claim 8, characterized in that mRNA detection is carried out by means of real time quantitative RT- PCR (Q-PCR).

16. The use of nucleotide or peptide sequences derived from the dusp6 gene for detecting *in vitro* the presence of a demyelinating disease in an individual, especially multiple sclerosis, for determining *in vitro* the stage or severity of said demyelinating diseases in the individual, or for monitoring

in vitro the effect of the therapy administered to an individual presenting said demyelinating diseases.

17. An *in vitro* method for identifying and evaluating the efficacy of compounds for therapy of demyelinating diseases, preferably multiple sclerosis, comprising:

a) treating a primary culture of rat optic nerve oligodendrocytes with stimuli relevant to demyelinating diseases, preferably with excitotoxic stimuli such as Ampa or Kainate

b) detecting and quantifying changes in the dusp6 gene or DUSP6 protein expression in culture cells in response to said stimuli,

c) contacting the pure culture of stimulated oligodendrocytes obtained in step a) with the candidate compound under the conditions and for the time suitable for permitting them to interact,

d) detecting and quantifying the dusp6 gene or DUSP6 protein expression levels, and

e) comparing the expression levels obtained in step d) with the corresponding levels in pure cultures of stimulated oligodendrocytes not treated with the candidate compound.

18. The use of nucleotide or peptide sequences derived from the dusp6 gene in methods of search, identification, development and evaluation of efficacy of compounds for therapy of the neurodegenerative phase of demyelinating diseases, preferably for multiple sclerosis.

19. Use of an agent that inhibits DUSP6 protein expression and/or activity, or that inhibits the lethal effects of induction of DUSP6 protein expression, in the manufacturing of a pharmaceutical composition for the treatment of the neurodegenerative phase of demyelinating diseases, especially

multiple sclerosis.

20. Use according to claim 19 wherein said agent is selected from the group formed by:

a) an antibody, or combination of antibodies, specific against one or more epitopes present in the DUSP6 protein, preferably a human or humanized monoclonal antibody; also being possible a fragment of the antibody, a single-chain antibody or an anti-idiotype antibody,

b) cytotoxic agents, such as toxins, molecules with radioactive atoms, or chemotherapeutic agents, which include, without limitation, small organic and inorganic molecules, peptides, phosphopeptides, antisense molecules, ribozymes, triple helix molecules, small interference RNA, double-strand RNA, etc., inhibiting DUSP6 protein expression and/or activity, such as, for example, the dusp6 specific antisense oligonucleotides SEQ ID NO:3 or SEQ ID NO:4, or any antisense oligonucleotide with an homology with said molecule exceeding 50%, or any dusp6 specific antisense oligonucleotide inhibiting its expression, and

c) DUSP6 protein antagonist compounds inhibiting one or more of the DUSP6 protein functions.

21. Use according to claim 19, wherein said pharmaceutical composition further contains another active ingredient, preferably one which inhibits DUSP6 protein function.

22. A dusp6 specific antisense oligonucleotide selected from the group consisting of SEQ ID NO:3 and SEQ ID NO:4.

23. A kit that comprises an antibody that specifically recognizes the DUSP6 protein and a carrier in suitable packing.

24. A kit that comprises a primer pair designed to specifically amplify a nucleic acid having a sequence that is specific to the dusp6 gene.

25. A kit according to claim 24, wherein the sequence of the primer pair is selected from SEQ ID NO: 1 and SEQ ID NO: 2.

26. A kit according to anyone of claims 23 to 25 that is employed to detect the presence of demyelinating diseases in an individual, to determine the stage or severity of said conditions in an individual or to monitor the effect of the therapy administered to the individual with said conditions.